



Subject card

Subject name and code	Physical Methods of Materials Investigation II, PG_00039814						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	October 2020		Academic year of realisation of subject		2023/2024		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	4		Language of instruction		Polish		
Semester of study	7		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Solid State Physics -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marek Chmielewski				
	Teachers		dr hab. inż. Leszek Piotrowski				
			dr inż. Marek Chmielewski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	45		2.0		3.0	50
Subject objectives	The aim of the course is to prepare the student for experimental work in the field of multi-path testing of materials using non-destructive diagnostic techniques used to study the physical properties of matter, structures of the matter and to defects detections procedures.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_U08	The student creates reports from his/her work in a manner appropriate to scientific documentation, is able to control the completeness and sequence of the theses presented in the study, has the ability to make logical inferences and is able to record this information in a clear, stylistically correct manner.	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task
	K6_W06	Students will know the structure and operation of equipment used in study of materials, with particular emphasis on ultrasonic flaw detectors, measures the magnetic field, eddy currents meter, a device for measuring voltage pulses Barkhausen effect, magnetic recording systems dispersive device generation and detection of magnetostrictive pulses.	[SW1] Assessment of factual knowledge
	K6_K01	In carrying out tasks related to the topics of laboratory student will know the correct methods of carrying out the experiment, will be able to realize and understand the need for multi-track analysis of the results. Properly provide calibration procedures, and effectively uses these results to determine the unknown parameters of the measured elements	[SK2] Assessment of progress of work [SK1] Assessment of group work skills
	K6_U02	Implementation of laboratory tasks that require in-depth knowledge on the use and operation of modern measuring and recording systems. Acquisition of knowledge about the operation of programmable arbitrary generators, digital oscilloscopes, oscilloscope measurement cards, programmable measurement cards.	[SU1] Assessment of task fulfilment
	K6_W02	The student will know principle of the techniques used in the measurement process used in nanotechnology, to know the capabilities and limitations of technology and nanotechnology products	[SW1] Assessment of factual knowledge

Subject contents	In the course will be presented the following groups of topics: Methods for detection and determine defects or discontinuities: Radiographic method Endoscopic, Optical method Magnetic method - magnetic field leakage (MFL) Ultrasonic method Eddy current method The method of acoustic emission measurement other methods Methods for testing the quality of materials: Radiographic method (diffraction) Ultrasonic method Electromagnetic methods Mechanical spectroscopy Hardness measuring method. Methods of measuring residual stresses: The method of X-ray Neutron diffraction method Ultrasonic method Magnetic methods laboratory: 5 laboratory with the following titles. 1. Determination of stresses in the welded joint by measuring the intensity of Barkhausen noise effect. 2. The detection of surface and subsurface defects, together with an assessment of their size by measuring the magnetic field leakage (MFL). 3. The use of ultrasound for metal investigation and defect detection in metals. 4. The use of magnetostrictive pulses in non-contact method for defect detection in tubes. 5. Applying of eddy currents for metal testing, using a differential eddy current probe. seminar: Each student has to present the seminar on the subject close to the subjects implemented in the laboratory. Speech should include information on the method of measurement, description and characteristics of the measuring system, an present the example of the results obtained using the apparatus, and conclusion and summary of the presented method. Lecturer will point or provide the source of literature on possible topics for speeches. The recommended language is English materials.											
Prerequisites and co-requisites	not required											
Assessment methods and criteria	<table><tr><td>Subject passing criteria</td><td>Passing threshold</td><td>Percentage of the final grade</td></tr><tr><td>Labor</td><td>100.0%</td><td>60.0%</td></tr><tr><td>Lecture</td><td>50.0%</td><td>40.0%</td></tr></table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Labor	100.0%	60.0%	Lecture	50.0%	40.0%
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Recommended reading	<table><tr><td>Basic literature</td><td colspan="2"><i>Handbook of measurements of residual stresses</i>; ed. J. Lu; The Fairmont Press, 1996. Articles identified by the lecturer from NDT&E journals.</td></tr><tr><td>Supplementary literature</td><td colspan="2">not required</td></tr><tr><td>eResources addresses</td><td colspan="2">Adresy na platformie eNauczanie:</td></tr></table>			Basic literature	<i>Handbook of measurements of residual stresses</i> ; ed. J. Lu; The Fairmont Press, 1996. Articles identified by the lecturer from NDT&E journals.		Supplementary literature	not required		eResources addresses	Adresy na platformie eNauczanie:	
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Example issues/ example questions/ tasks being completed	Detection and registration of ultrasonic pulses The registration of a leaking magnetic field and its use in the area of searching for a structure's discontinuity Barkhausen effect used in determining the magnitude of strain.											
Work placement	Not applicable											